

## CLAIMS

What is claimed is:

- 1 1. A magnetic head, comprising:
  - 2 a magnetoresistive sensor including a ferromagnetic free layer having first and
  - 3 second laterally opposed ends, and
  - 4 an electromagnet having first and second pole ends adjacent said first and second
  - 5 laterally opposed ends of said free layer for biasing a magnetization of said
  - 6 ferromagnetic free layer in a predetermined direction.
- 1 2. A magnetic head as in claim 1, wherein said electromagnet further includes:
  - 2 a magnetic yoke; and
  - 3 an electrically conductive coil formed about a portion of said yoke.
- 1 3. A magnetic head as in claim 2 wherein said yoke is formed with a gap to prevent
- 2 electrical current from flowing through said yoke from said first pole end to said second
- 3 pole end.
- 1 4. A magnetic head as in claim 2 further comprising first and second leads formed over
- 2 said yoke.

1       5. A magnetoresistive sensor as in claim 3, wherein said yoke includes first and second  
2       portions separated by said gap and further comprising first and second electrically  
3       conductive leads formed over said first and second portions respectively of said yoke.

1       6. A magnetic head, comprising:  
2               a magnetoresistive sensor having first and second laterally opposed sides;  
3               a first magnetic layer having an end abutting said first side of said  
4               magnetoresistive sensor, and extending from said sensor;  
5               a second magnetic layer having an end abutting said second side of said  
6               magnetoresistive sensor, and extending from said sensor; and  
7               an electrically conductive coil formed about a portion of at least one of said first  
8               and second magnetic layers.

1       7. A magnetic head as in claim 6, comprising:  
2               first and second electrically conductive leads formed over said first and second  
3               magnetic layers respectively.

1       8. A magnetic head as in claim 6, wherein said coil comprises:  
2               a first set of parallel electrically conductive lines formed at a first elevation;  
3               a second set of parallel electrically conductive lines formed at a second elevation;  
4               and

5           a set of electrically conductive vias electrically connecting at least a portion of  
6           said first electrically conductive lines with said second set of electrically conductive  
7           lines.

1   9. A magnetic head comprising:  
2           a magnetoresistive sensor having first and second laterally opposed sides;  
3           a first front magnetic bias layer having a proximal end abutting said first side of  
4           said sensor and having a distal end;  
5           a second front magnetic bias layer having a proximal end abutting said second  
6           side of said sensor and having a distal end;  
7           a back magnetic bias layer having first and second ends;  
8           an electrically conductive coil formed about a portion of said back magnetic bias  
9           layer;  
10          a portion of said first front bias layer overlapping a portion of said back bias  
11          layer;  
12          a portion of said second bias layer overlapping a portion of said back bias layer;  
13          and  
14          said first and second front bias layers being electrically isolated from said back  
15          bias layer.

1   10. A magnetic head as in claim 9 wherein:  
2           said distal end of said first front bias layer overlaps said first end of said back bias  
3           layer; and

4           said distal end of said second bias layer overlaps said second end of said back bias  
5           layer.

1    11. A magnetic head as in claim 10 further comprising;  
2           a dielectric layer disposed between said first bias layer and said first end of said  
3           back bias layer; and  
4           a dielectric layer disposed between said second bias layer and said second end of  
5           said back bias layer.

1    12. A magnetic head as in claim 10 wherein said dielectric layer formed between said  
2           first front bias layer and said first end of said back bias layer, and said dielectric  
3           layer formed between said second front bias layer and said second end of said back  
4           bias layer are each part of a contiguous bias layer.

1    13. A magnetic head as in claim 9 wherein said first and second front bias layers and  
2           said back bias layer are formed of a soft magnetic mateiral.

1    14. A magnetic head as in claim 9 wherein said first and second front bias layers and  
2           said back bias layer are formed of NiFe.

1    15. A magnetic head as in claim 2, wherein said yoke comprises soft magnetic material;

1    16. A magnetic head as in claim 2, wherein said yoke comprises a material selected from  
2    the group consisting of NiFe, FeXN (where X is Al, Ta or Co), CoFe, Sendust, CZT or  
3    CZN.

1    17 A magnetic head as in claim 6, wherein said first and second magnetic layers  
2    comprise a soft magnetic material.

1    18. A magnetic head as in claim 6, wherein said first and second magnetic layer  
2    comprise NiFe

1    19. A magnetic data storage system, comprising:  
2       a magnetic disk  
3       a motor connected with said disk for rotating said disk;  
4       a slider;  
5       an actuator connected with said slider for moving said slider relative to said disk;  
6       a magnetic head connected with said slider, comprising:  
7           a magnetoresistive sensor having first and second laterally opposed sides;  
8           a first magnetic layer having an end abutting said first side of said  
9       magnetoresistive sensor, and extending from said sensor;  
10          a second magnetic layer having an end abutting said second side of said  
11       magnetoresistive sensor, and extending from said sensor; and  
12          an electrically conductive coil formed about a portion of at least one of  
13       said first and second magnetic layers.

1       20. A magnetic data recording system comprising:

2           a magnetic tape;

3           a motor for moving said magnetic tape;

4           a magnetic head mounted adjacent said magnetic tape; said magnetic head

5       comprising:

6           a magnetoresistive sensor having first and second laterally opposed sides;

7           a first magnetic layer having an end abutting said first side of said

8           magnetoresistive sensor, and extending from said sensor;

9           a second magnetic layer having an end abutting said second side of said

10          magnetoresistive sensor, and extending from said sensor; and

11          an electrically conductive coil formed about a portion of at least one of

12          said first and second magnetic layer.